Regional Operational Plan SF.2A.2013.04

Operational Plan: Little Susitna River Salmon Weir 2013 - 2015

by

Suzanne Hayes

May 2013

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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LITTLE SUSITNA RIVER SALMON WEIR 2013 - 2015

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Alaska Department of Fish and Game, Sport Fish-, Palmer

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Sport Fish

May 2013

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Signature Page

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Project leader(s):	*Suzanne Hayes, Fisheries Biologist II*
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Project Nomenclature:	
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Field Dates:	May 15 – September 15
Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project leader	Suzanne Hayes	Suzanne R Hayes	4/4/2013
Biometrician	Adam Craig		4/4/2013
Research Coordinator	Jack Erickson	Jack M. Erickson	5/20/2013

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PURPOSE

This project will provide information on the Little Susitna River Chinook and coho salmon escapements for timely inseason management of the sport fisheries targeting these stocks. It will accurately document if coho salmon escapement goals have been met, and will aid in the refinement/development of new escapement goals for Chinook salmon. The coho salmon Sustainable Escapement Goal (SEG) has not been achieved in the past four consecutive years. Similarly the Little Susitna River Chinook salmon SEG was not met in two of the past four years (Table 1).

Chinook salmon escapements have been monitored in the Little Susitna since 1983 with a post season single pass aerial survey conducted from helicopter except for four years, when they were also counted at a weir (Table 1), and four years when conditions were not clear enough to perform the aerial survey. A SEG of 900 – 1,800 fish (aerial survey) was established for Little Susitna River Chinook salmon in 2002 (Bue and Hasbrouck 2001). Successful operation of the weir over a number of seasons to count Chinook salmon and collect biological data could lead to development of the spawner-recruit relationship and a weir-based escapement goal over time. Total run construction and the ability to forecast future returns may also be possible. Achievement of the current SEG will continue to be assessed by aerial survey until a weir based SEG can be formulated. Counting Chinook inseason at the weir located low in the river(RM 32.5) will make it more likely that management action can be taken early enough to ensure making the Chinook salmon SEG.

Coho salmon escapements for the Little Susitna River have been measured by weir in 1986, and from 1988 to 2012, but not in a consistent location (Table 1). The weir was moved from the RM 32.5 at the public's request (Whitmore and Sweet 1997). From 1996 – 2011 the coho weir was operated at river mile (RM) 71 (Figure 2). In 2012 it was moved back to RM 32.5. A sustainable escapement goal (SEG) of 10,100 – 17,700 fish (weir) was established for Little Susitna River coho salmon in 2002 (Bue and Hasbrouck 2001). Inseason management of the coho fishery was difficult with the weir at RM 71 due to the lag between the time the fish were being harvested in the fishery and the time the majority had been counted at the weir. The midpoint of the run at RM 32.5 was about August 13 and at RM 71 it was September 1. Similar to the Chinook program, operating the weir in the lower river (RM 32) will allow for improved inseason management of the coho fishery.

BACKGROUND

The Little Susitna River drainage originates at the Mint Glacier in the Talkeetna Mountains north of Palmer and Wasilla and flows into Cook Inlet approximately 7 miles east of the mouth of the Susitna River (Figure 1). The river is approximately 110 miles long with about 70 miles open to fishing for salmon, from the mouth to the George Parks Highway Bridge at the community of Houston. The Little Susitna River supports runs of Chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, sockeye salmon *O. nerka*, pink salmon *O. gorbuscha*, and chum salmon *O. keta*.

The Little Susitna River supports a large recreational fishery; the average effort from 2000 – 2010 expended at the Little Susitna River was 32,354 angler days. This is about 11 % of the entire sport fishing effort in the Northern Cook Inlet Management Area (NCIMA). The Little Susitna River supports one of the largest coho salmon fisheries in the NCIMA and the third

largest in the state. Anglers harvested 13,800 coho salmon from 2000 – 2010 on average. (Walker et al. 2003, Jennings et. al. 2004, 2006a-b, 2007, 2009a-b, 2010a-b, 2011 a-b). From 1996 – 2012 coho salmon escapements varied wildly from a low of 3,017 to a high of 47,938 coho salmon (Table 1.).

The Little Susitna River supports the fourth largest Chinook salmon fishery in the NCIMA. Sport harvest of Chinook salmon for 2000 – 2010 averaged 2,400 fish (Walker et al. 2003, Jennings et. al. 2004, 2006a-b, 2007, 2009a-b,2010a-b, 2011 a-b).. Chinook salmon escapements in the four years the weir was operated ranged from 2,809 to 7,374 (Table 1).

Table 1.–Chinook and coho salmon escapements to the Little Susitna River.

		Chinook salmon		Coho salmon	
Year	Weir location	Weir count	Aerial Survey	Weir count	hatchery contribution
1983			929		
1984			558		
1985			1,005		
1986	RM 34.5		[a]	7,511	
1987	RM 34.5		1,386	[b]	
1988	RM32.5	7,374	3,197	21,437	4,428
1989	RM32.5	4,367	[a]	15,855	6,862
1990	RM32.5		922	15,511	3,370
1991	RM32.5		892	39,241	8,322
1992	RM32.5		1,441	21,182	2,690
1993	RM32.5		[a]	34,822	9,189
1994	RM32.5	2,981	1,221	28,948	5,442
1995	RM32.5	2,809	1,714	12,266	1,135
1996	RM71		1,079	15,803	0
1997	RM71		[a]	9,894 [c]	0
1998	RM71		1,091	15,159	0
1999	RM71		[a]	3,017 [c]	0
2000	RM71		1,094	15,436	0
2001	RM71		1,238	30,587	0
2002	RM71		1,660	47,938	0
2003	RM71		1,114	10,877	0
2004	RM71		1,694	40,199	0
2005	RM71		2,095	16,839 [c]	0
2006	RM71		1,855	8,786 [c]	0
2007	RM71		1,731	17,573	0
2008	RM71		1,297	18,485	0
2009	RM71		1,028	9,523	0
2010	RM71		589	9,214	0
2011	RM71		887	4,826	0
2012	RM32.5		1154	6,779	0
SEG			900 - 1800	10,100 - 17,700	

[a] No count conducted, water too turbid.
[b] No complete count weir washed out.
[c] Incomplete counts due to high water or flood.

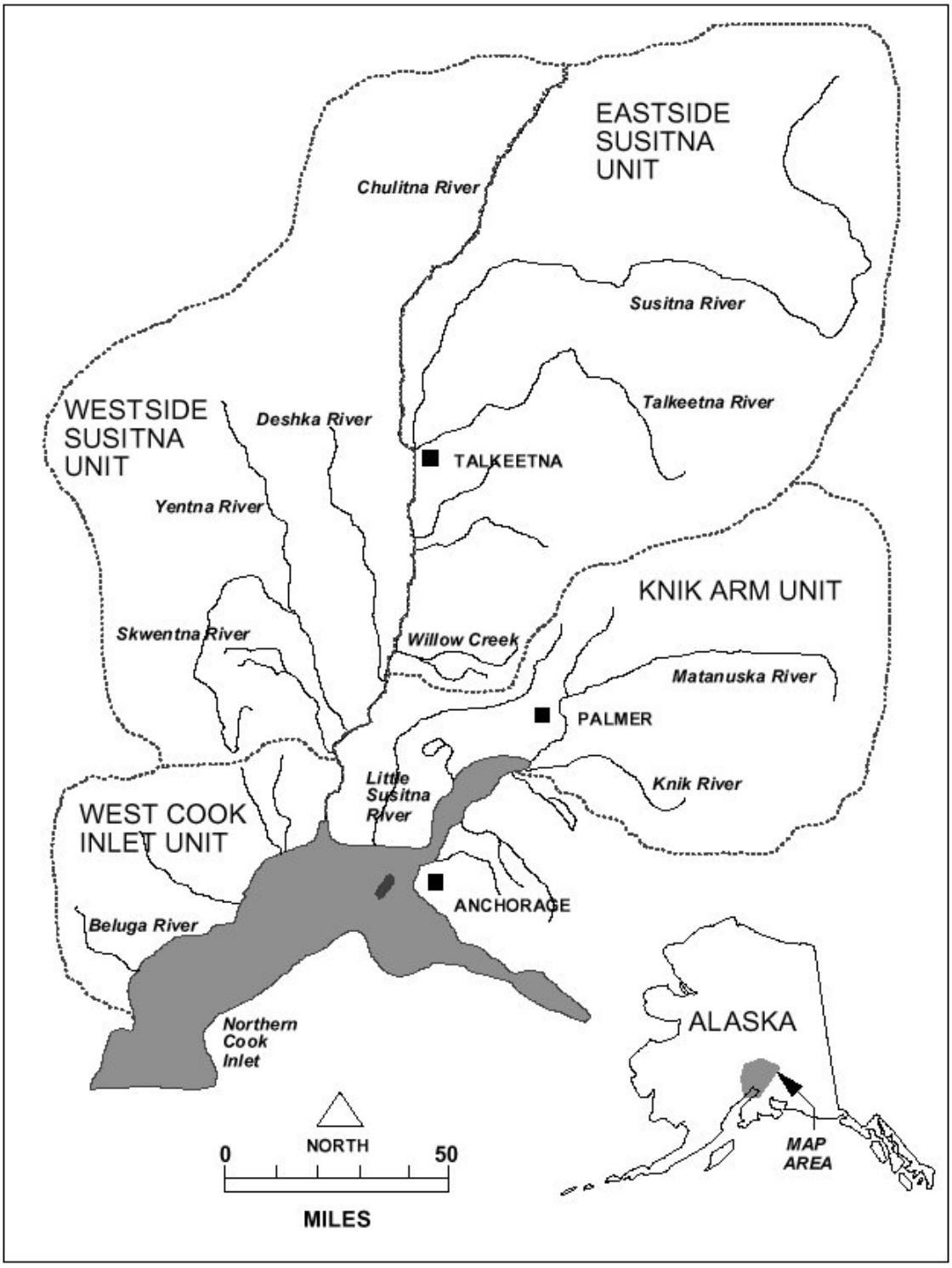

Figure 1. The Knik Arm Management Unit (KAMU) in the Northern Cook Inlet Management Area (NCIMA).

Figure 2. Location of the Little Susitna River weir from 1986 -2011.

OBJECTIVES

The objectives for the Little Susitna River Chinook salmon weir project are:

1. To count the number of adult Chinook salmon in the Little Susitna River that pass through the weir at river mile (RM) 32.5 from late May through late August.
2. To estimate the age composition and sex composition of the adult Chinook salmon escapement to the Little Susitna River upstream of RM 32.5, from late May through late August; such that the estimates are within ± 7 percentage points of the true values 95% of the time.

The objectives for the Little Susitna River coho salmon weir project are:

1. Count the number of adult coho salmon in the Little Susitna River that pass through the weir at RM 32.5, from July 1 through approximately September 15.
2. Estimate the sex composition of the coho salmon counted at the Little Susitna River weir site upstream of RM 32.5 from July 1 through approximately September 15; such that the worst case estimates are within ± 12 percentage points of the true values 90% of the time.

SECONDARY OBJECTIVES

1. Interview anglers sport fishing for Chinook and coho salmon upstream of the weir for harvest information.
2. Identify and count all species of fish that move through the live trap from weir installation until weir removal.
3. Estimate mean length-at-age, and age-by-sex composition for Little Susitna River Chinook.
4. Estimate mean length by sex for Little Susitna River coho salmon.
5. Collect and preserve scales from a sample of coho salmon.
6. Collect a baseline genetic sample from Little Susitna coho salmon.
7. Record water temperature twice daily and water stage once daily for inseason management purposes.
8. Record hourly water temperatures for post season review.

METHODS

STUDY DESIGN

Escapement

A resistance-board weir similar to those described in Bartlett (1996) and Tobin (1994) will be located on the Little Susitna River at RM 32.5 to count salmon from the third week in May until mid- September. This weir is operated primarily to count Chinook and coho salmon, but pink salmon, sockeye salmon, chum salmon, northern pike *Esox lucius*, rainbow trout *Onchorhynchus mykiss*, Arctic grayling *Thymallus arcticus*, Dolly Varden *Salvelinus malma*, Pacific lamprey

Lampetra tridentata, round whitefish Coregonus cylindraceum, and longnose suckers *Catostomus catostomus* will also be counted.

Spaces between adjacent pickets on the weir and live trap are ≤38 mm (1.5 in); this spacing will prevent all but the smallest 0-ocean-age (jack) coho salmon and small pink salmon from passing between pickets. Technicians will count fish passing through the live trap; fish that pass through the pickets will not be recorded.

The majority of the Chinook salmon pass through the weir from early June to the middle of July. Coho, pink, sockeye, and chum salmon are expected to migrate past the weir from mid July until early September. All species of fish will be counted through the live trap during daylight hours. The trap will be closed at night, during breaks, and while boats pass.

High water events partially submerged the resistance–board weir at RM 32.5 during the coho salmon run in 1989 and 1995 (Bartlett and Sonichsen 1990, Bartlett 1996). When the weir is partially submerged, it is possible that salmon pass over the weir undetected. Technicians will attempt to keep the weir floating during high water events, by removing debris that is submerging the panels. However, if this is no longer possible, technicians will record the time and date that the weir is submerged, and will record details about how much of the weir is submerged. When water stage drops, and the water turbidity decreases enough so that salmon can be positively identified and counted, the date and time will be recorded when counting has resumed.

Age and Sex Compositions

Chinook salmon

The Chinook salmon age, sex and length (ASL) sample size was calculated using the procedures outlined by Thompson (1987)[1], adjusting for a finite population and for a non-readable scale rate of 25%. The sample size goal for the objective criterion of ± 7 percentage points of the true value 95% of the time is 347 fish.

Proportional sampling will be used to obtain the 347 ASL samples. The sampling rate will start off each year as 1:5 unless an addendum is attached to this operational plan. During 1988, 1994 and 1995 both weir counts and aerial survey counts were performed on the Little Susitna. The aerial survey count was approximately 48% of the weir count on average. Using the lower end of the escapement goal of 900 Chinook and dividing by 48% provides a possible minimum run size of 1,875 Chinook. A 1:5 sampling rate will provide a sample size of 375 Chinook under these conditions and exceed the sample size goal of 347. The lower end of the escapement goal range was used because managers will attempt to manage the harvest so that an escapement within the SEG goal range is achieved.

[1] The procedures outlined by Thompson (1987) are generally applicable for sample size determination when the sampling design is of the simple random sample type. Our sample survey is of the stratified random sample type. This sample size procedure was used for two reasons: (1) since sample allocation is planned to be proportional the resultant sample can be treated as if collected by a simple random sampling process by ignoring strata, assuming proportional sampling is realized; and (2) sample sizes are conservative using this approach.

The number of ASL samples to take on a given day will be set by dividing the previous day's total Chinook salmon count by 5. Proportional sampling will be periodically reviewed and adjusted if obtaining too small or too large of a sample seems likely.

Coho Salmon

The sample size goal for estimating sex composition is set at 50 coho salmon per sample period (7 days). A total of 6 sample periods over the run will yield 300 samples. Taking 50 age, length and sex (ALS) samples period beginning July 22 and ending September 1 will provide samples from the majority of the run. Past coho runs have ranged from 84 % to 100% complete by September 1 at RM 32.5.

Sampling will likely not be in proportion to the run. Post-season stratification may be used to address potential bias stemming from this. In the worst case scenario the entire run passes through the weir in just one week providing only 50 samples. The stated precision criterion for sex composition estimates should still be achieved, but the estimates may be biased.

The sample size goal for creating a genetic baseline for Little Susitna river coho salmon is 100 coho salmon annually, axillary processes will be removed from 25 coho salmon per sample period (7 days), starting on July 29 and ending August 25. Past coho runs at RM 32.5 have ranged from 71% to 99% complete by August 25.

Angler Interviews

Anglers fishing for Chinook or coho salmon upstream of the weir will be asked as they pass downstream over the weir how many Chinook or coho salmon they harvested. The number of salmon harvested upstream of the weir will be recorded on the daily report form (Appendix A).

Non-Target Species

To the extent possible, technicians will identify, count, and record all fish species that move through the trap while the weir is operational. Fish not readily identifiable will be removed from the water and examined.

Temperature and Water Clarity

A protected glass thermometer will be submerged in the river and attached to the trap at the beginning of the season. The thermometer will be pulled out of the river daily at 0900 and 1800 hours; temperature will be read to the nearest whole degree Celsius and recorded on the daily report form (Appendix A).

In addition, a HOBO water temperature Pro v2 ® logger made by Onset Computer Corp., will be anchored to the rail approximately 20 feet from the shore, at the beginning of the season, and will log the stream temperature each hour. The temperature data from the logger will be transferred to the principal investigators' computer after weir removal.

Water clarity will be judged by the technician as excellent, acceptable, or poor each morning at 0900 hours, this observation will be recorded on the daily report form (Appendix A).

DATA COLLECTION

Escapement

The following information will be collected each day, and reported to the Palmer ADF&G Office before 8:00 a.m. the following day:

1. The number of salmon by species counted through the live trap;
2. The number of salmon by species harvested above the weir;
3. The number of salmon by species sampled for age, length, and sex;
4. The number of female fish in the age, length, sex sample;
5. The number of other fish, by species, that passed through the live trap;
6. Instantaneous water stage and water temperature;
7. The number of boats that passed upstream over the weir;
8. Any comments regarding the ability to accurately count salmon through the live trap.

The information detailed above will be recorded on the daily report form (Appendix A). In addition, daily and cumulative values of salmon counted and sampled will be recorded in a Rite-In-the-Rain® notebook that will be turned into the principle investigator at the end of the season.

The crew will clean and inspect the weir for gaps that would allow salmon to pass through the weir undetected, at least daily and more frequently if conditions warrant. The crew will monitor the weir closely during daylight hours, and pass fish in a timely fashion, to minimize impeding the upstream migration of salmon.

Age, Sex, and Length

Once the technicians observe enough coho or Chinook salmon in the trap to make sampling worthwhile, the trap will be closed. All fish in the trap will be sampled even if the number of fish exceeds the ratio or sample period goal. This is to prevent any type of selection bias.

Sampling crews will attempt to sample Chinook salmon daily to meet the ratio stated in the Study Design section of this operational plan. Varying combinations of water level, water temperature, water clarity, cloud cover, rain, date, run progression, and boat traffic influence the number of fish that can be trapped in a day. If sufficient samples are not obtained on a given day, extra fish will be sampled in subsequent days to maintain sampling goals for the run.

Coho salmon do not have to be sampled daily, as only 50 ASL samples are required per 7-day period. Technicians will determine the time during the period when the 50 ASL samples can be taken, so as to take advantage of fish movement while minimizing the disruption to the upstream migration of salmon.

Sampled fish will be measured from mid-eye to fork-of-tail to the nearest 0.5 cm. Sex will be determined by external physical characteristics, such as kype development or a protruding ovipositor. Length and sex will be recorded in Rite-In-the Rain® notebooks while sampling and

later transferred to standard age, weight, and length (AWL) version 1.2 mark-sense forms (Heineman unpublished; Appendix B).

Three scales from each sampled fish, will be taken from the preferred location on the left side of the body, at a point on a diagonal line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, and two rows above the lateral line (Welander 1940, Scarnecchia 1979). If the preferred scales cannot be obtained, another scale will be taken from as close to the preferred scale as possible, and always from the first or second row above the lateral line, in order to capture the early life history portion of the age. If no scales are available in the preferred area on the left side of the fish, scales will be collected from the preferred area on the right side of the fish. If scales are not obtainable from a given fish, that fish will not be sampled at all and sampling will continue with the next available fish.

The axillary process will be taken from every other coho salmon sampled for Age, sex and length from July 29 – August 25. The sample will be cleaned of sand and slime and will be placed in a small numbered plastic vial (please see Appendix C for complete instructions). The vial number will be recorded in the Rite-In-the Rain® notebooks while sampling. The vial number will be recorded as a tag number, on the back of the standard age, weight, and length (AWL) version 1.2 mark-sense form, for each fish that is sample for genetic tissue (Heineman unpublished; Appendix B).

Scales will be mounted on gum cards and impressions made in cellulose acetate as described in Clutter and Whitesel (1956) and Scarnecchia. (1979). The corresponding litho-code and line numbers from the mark-sense form will be recorded on the gum card along with the date, collector name, and location. The impressions will be magnified and viewed on a microfiche reader and the ages will be determined from the growth patterns of the circuli. Ages will be reported in European notation (Jearld Jr. 1983) and recorded on AWL forms.

DATA REDUCTION AND ANALYSIS

Escapement

The field crew will maintain the daily report form (Appendix A) and a field notebook of daily information (detailed in Data Collection-Escapement above) at the weir field camp. Daily information received over the telephone will be entered into the Inseason Excel® spreadsheet at the Palmer ADF&G office. At the end of the season, the data in the daily report form will be reconciled with the data that was recorded via telephone during the season. If discrepancies occur, the project biologist and field crew will confer to determine the appropriate values. The fields in the Little Susitna inseason worksheet will be: date, Chinook daily count, Chinook harvest above weir, cumulative escapement, Chinook run projection, Chinook sampled, percent of Chinook sample that are female, the sample ratio, daily count of coho salmon, cumulative coho escapement, coho run projection, coho daily sampled, daily harvest of coho above the weir, daily count of sockeye salmon, daily count of chum salmon, daily count of pink salmon, daily count of northern pike, daily count of rainbow trout, daily count of whitefish, water stage, water temperatures, water clarity, boats, rafts, and canoes through the weir, and comments. If floods or weir breakdowns allow fish to pass uncounted, no adjustment will be made to the final escapement abundance. Instead it will be noted how many hours of data are missing and that the counts are biased low. The 2013 Little Susitna River Chinook salmon escapement data will be

updated and available on the Sport Fish Division's Docushare repository (http://docushare.sf.state.ak.us). A copy of the Inseason spreadsheet will also be maintained in the Palmer ADF&G office. Hourly water temperature data will be stored on the Palmer ADF&G local area network.

Age and Sex Compositions

Field crews will record data in a Rite-In-the-Rain® notebook while sampling, and then transfer the data onto AWL forms in the field. The assistant project biologist will correct any errors and enter the ages on the forms. The AWL forms will be sent to Sport Fish Division Research and Technical Services, scanned into an electronic text file, and the resulting file will be archived in Sport Fish Division's Docushare repository (http://docushare.sf.state.ak.us) with data fields and formats conforming to Heineman (unpublished). A copy of the text file will also be maintained in the Palmer ADF&G office. The text file will be imported into an Excel spreadsheet and all analysis done from that spreadsheet.

The sampling protocol for Chinook salmon is one that attempts proportional sampling of the total escapement. If the proportional sampling is achieved, then all collected samples will be pooled and unstratified estimates will be calculated for both age and sex compositions. If proportional sampling is not achieved, then the entire run will be split into four temporal strata based on the daily escapement counts such that each stratum represents approximately a quarter of the total run. The decision whether to use stratified or unstratified estimator for age composition and sex composition will be based on the results of the likelihood ratio test (G-test) (Sokal and Rohlf, 1995). The likelihood ratio test statistic, G-statistic, will be calculated as:

$$G = 2\sum_i f_i \ln\left(\frac{f_i}{\hat{f}_i}\right) \tag{1}$$

where f_i is the observed number of fish in the i^{th} cell of the age-by-time or sex-by-time contingency table, and $\hat{f}_i$ is the expected number of fish in the i^{th} cell calculated under the independence condition (i.e. age and sex proportions don't change over time). G-statistic has an approximate χ^2-distribution with $(r\text{-}1)(c\text{-}1)$ degrees of freedom, where r is the number of rows and c the number of columns in the table.

For clarity, the following description and formulae were developed in terms of estimating the age composition, however estimating the sex composition is treated exactly identical.

Applied to the age counts by time strata G-test will determine (with $\alpha = 0.05$) if the age composition is dependent on time. If independent of time, age proportions for the escapement ($\hat{p}_z$), as well as the number of fish per age class ($\hat{N}_z$) and their estimated variances, will be calculated using equations (2) through (5) with the pooled data. If not, then the stratified estimates will be calculated as described below.

The age proportions of the Chinook salmon escapement by sampling stratum will be estimated as:

$$\hat{p}_{tz} = \frac{n_{tz}}{n_t} \tag{2}$$

where $\hat{p}_{tz}$ is the estimated proportion of salmon passing the weir during sampling stratum *t* from age category *z*, n_{tz} equals the number of fish sampled during sampling stratum *t* that were classified as age category *z*, and n_t equals the number of Chinook salmon sampled for age determination during sampling stratum *t*.

The variance of $\hat{p}_{tz}$ will be calculated by:

$$\mathrm{var}\left[\hat{p}_{tz}\right] = \left(1 - \frac{n_t}{N_t}\right)\frac{\hat{p}_{tz}\left(1-\hat{p}_{tz}\right)}{n_t - 1} \tag{3}$$

where N_t is the number of Chinook salmon passing the weir during sampling stratum *t*.

The estimates of escapement by age categories in each sampling stratum will be calculated by:

$$\hat{N}_{tz} = N_t \hat{p}_{tz} \tag{4}$$

with its variance estimated as:

$$\mathrm{var}\left[\hat{N}_{tz}\right] = N_t^2 * \mathrm{var}\left[\hat{p}_{tz}\right] \tag{5}$$

The total escapement abundance by age category and its variance will then be estimated by summation:

$$\hat{N}_z = \sum_{t=1}^{L} \hat{N}_{tz} \qquad \mathrm{var}\left[\hat{N}_z\right] = \sum_{t=1}^{L} \mathrm{var}\left[\hat{N}_{tz}\right] \tag{6}$$

where: L equals the number of sampling strata.

Finally, the total proportion of the escapement by age categories and its variance will be estimated by:

$$\hat{p}_z = \frac{\hat{N}_z}{N} \qquad \mathrm{var}\left[\hat{p}_z\right] = \frac{\mathrm{var}\left[\hat{N}_z\right]}{N^2} \tag{7}$$

For coho, sex composition estimates and their variances will be calculated by using equations (2) through (7) with L equals six time strata.

Estimates of age-by-sex composition for Chinook salmon sampled from the escapement will also be calculated by using equations (2) and (3) with the subscript *z* representing age-by-sex categories.

Mean length at age

For Chinook mean length at age class *k* and coho mean length by sex *k* will be estimated by:

$$\bar{l}_k = \frac{1}{n_k}\sum_{i=1}^{n_k} l_i \tag{8}$$

where

l_i = the length of fish *i* in a sample n_k and

n_k = the number of Chinook salmon of age class *k* or the number of coho salmon of sex *k*.

The variance of the mean length-at-age class *k* will be estimated by:

$$\text{var}(\bar{l}_k) = \frac{1}{n_k} \frac{\sum_{i=1}^{n_k} (l_i - \bar{l}_k)^2}{n_k - 1} \quad (9)$$

Genetic Sample

The project biologist or the assistant project biologist will sort the Age, Sex and Length file by vial number and will forward this information in an excel spreadsheet along with the samples to the Commercial Fisheries Genetic Lab in Anchorage.

SCHEDULE AND DELIVERABLES

Dates of sampling events and other activities are summarized below. 2013 results will be published in a Report to the Board of Fisheries (FMR), in 2014, and data from 2014 and 2015 will be reported in the Area Management Report for the recreational fisheries of Northern Cook Inlet, 2014 and 2015. An annual Little Susitna weir summary memo will also be prepared for the Area Management Biologist.

SCHEDULES AND REPORTING

Date	*Activity*
May 21 - September 15	Data collection
November 30	Scale Reading
December 15	Data analysis
December 15	Data Archiving s
February 15	Summary memo

RESPONSIBILITIES

List of Personnel and Duties:

Fishery Biologist II Oversees project by writing operational plan, preparing and tracking budgets, hiring and supervising crewmembers, tracking implementation of operational plan, providing assistance and direction when needed. Provides inseason data to appropriate personnel. Provides final escapement data to the Area Manager for inclusion in the AMR.

Biometrician III Provides statistical supervision and shares design and writing of the operational plan with the Principle Investigator. Reviews and provides statistical support for the data analysis.

Fishery Biologist I Establishes safe field camp and coordinates weir installation and removal. Maintains daily contact with the field crew, routinely visits with the crew to observe activities, provides assistance and discusses weir operation with the field crew. Ages scales, edits forms, performs data analysis, and provides a summary memo to the NCI Area Management Biologist. Lead the inventory, organizing, repair and storage of all gear at the completion of the season.

Fish and Wildlife Technician III Duties: Perform counting, capture and biological sampling of fish. Train crew members in how to operate the weir, operate boats safely, record data, identify fish, and perform biological sampling. Report counts and all other data to the Palmer office daily. Perform weir inspection and maintenance daily. Maintain field camp equipment.

Fish and Wildlife Technician II Duties: Perform counting, capture and biological sampling of fish. Report counts and all other data to the Palmer office daily. Perform weir inspection and maintenance daily. Maintain field camp equipment.

BUDGET SUMMARY

FY14 Knik Arm Coho Request

Line Item	Category	Budget (x$1,000)
100	Personnel	44.3
200	Travel	0.6
300	Contractual	6.6
400	Commodities	10.3
500	Equipment	0
Total		61.80

FY 14 Little Susitna Salmon Weir Request

Line Item	Category	Budget (x$1,000)
100	Personnel	80.3
200	Travel	0.0
300	Contractual	7.9
400	Commodities	8.8
500	Equipment	0.0
Total		97.0

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APPENDIX A: SAMPLING FORMS

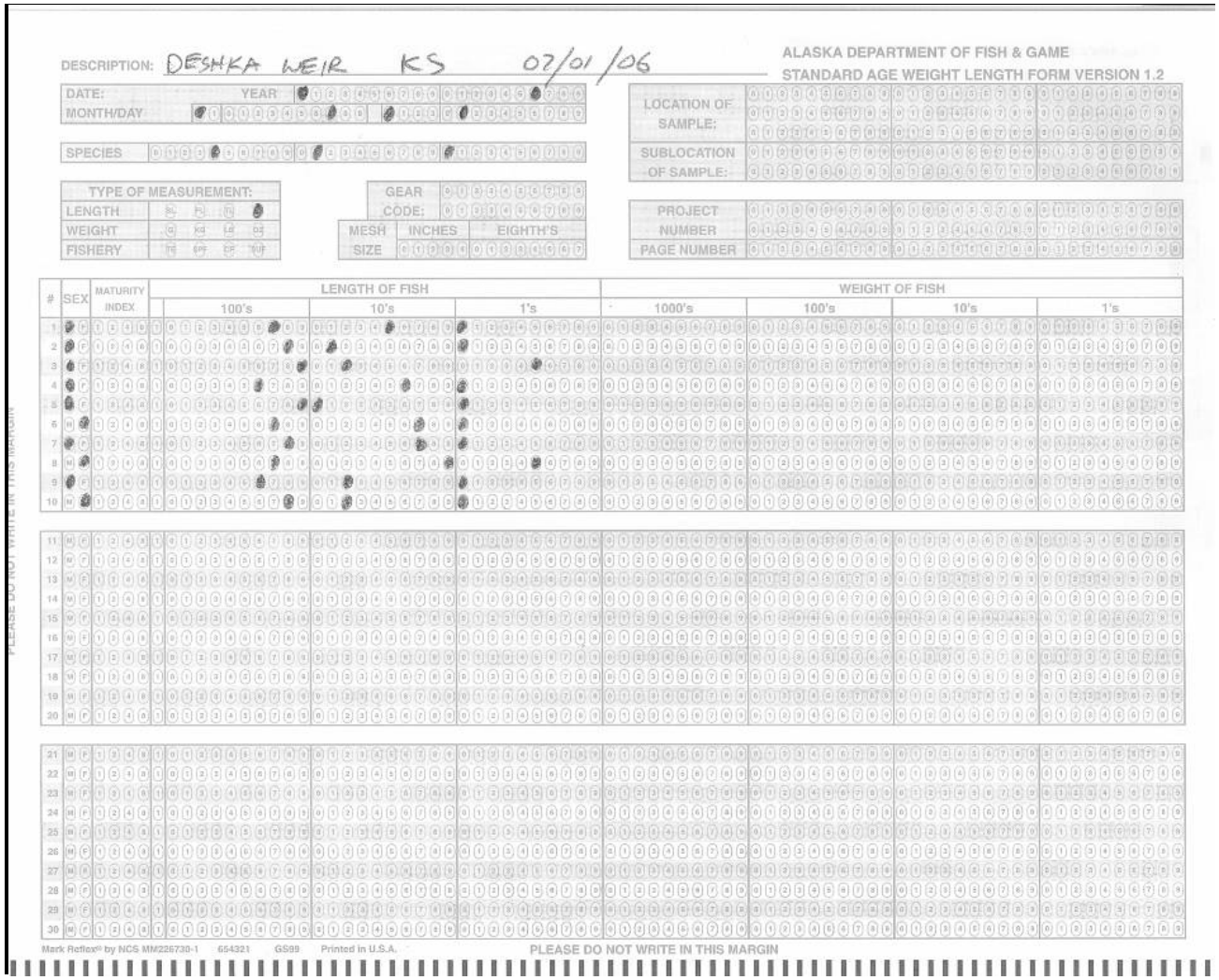
Appendix A 1.–Little Susitna Weir , Daily Report Form.

Year:_____Page _____ of _____.

Date		**Chinook Salmon**				**Coho Salmon**			**Pink Salmon**		**Chum**	**Sockeye**	**NP**	**RBT**	**LNS**	**Stream Conditions**				**Boats**	**Rafts**	**Notes**
Day	Date	Count	Harvest	Scales	# F	Count	Harvest	Scales/ Genetic	Count	Count type	Counts		Counts			Stg.	AM Temp	PM Temp	Clarity			

APPENDIX B: EXAMPLE OF A COMPLETED STANDARD AGE WEIGHT LENGTH FORM

Appendix B1.- Example of a completed Standard Age Weight Length form, front side contains date, sex and length information.



APPENDIX C: INSTRUCTIONS FOR COLLECTING AXILLARY PROCESS TISSUE SAMPLES FOR DNA ANALYSIS

Appendix C1.-Instructions for collecting axillary process tissue samples for DNA analysis.

Non-lethal Sampling Finfish Tissue for DNA Analysis

ADF&G Gene Conservation Lab, Anchorage

I. General Information

We use axillary tissue samples from individual fish to determine the genetic characteristics and profile of a particular run or stock of fish. The most important thing to remember in collecting samples is that **only quality tissue samples give quality results**. If sampling from carcasses: tissues need to be as "fresh" and as cold as possible and recently moribund, do not sample from fungal fins.

Sample preservative: Ethanol (EtOH) preserves tissues for later DNA extraction without having to store frozen tissues. Avoid extended contact with skin.

II. Sample procedure:

1. Tissue type: Axillary process; clip one axillary process from each fish (see attached print out).
2. Prior to sampling, fill the tubes half way with EtOH. Fill only the tubes that you will use for a particular sampling period. The squirt bottle is for day use only since it will leak if unattended.
3. To avoid any excess water or fish slime in the vial, wipe the axillary process dry prior to sampling. Using the dog toe nail clipper or scissors, clip off axillary process (**1/2 -1 " max**) to fit into the cryovial.
4. Place axillary process into EtOH. The ethanol/tissue ratio should be **slightly less than 3:1** to thoroughly soak the tissue in the buffer.
5. Top up tubes with EtOH and screw cap on securely. Invert tube twice to mix EtOH and tissue. Periodically, wipe or rinse the clippers so not to cross contaminate samples.
6. Data to record: Record each vial number to **paired data** information, electronic copy preferred.
7. Discard remaining ethanol from the 500ml bottles before shipping. **Tissue samples must remain in 2ml ethanol**, these small quantities require HAZMAT paperwork. Please follow packing instructions for HAZMAT items. Store vials containing tissues at room temperature, but away from heat. In the field: keep samples out of direct sun, rain and store capped vials in a dry, cool location. Freezing not required.

III. Supplies included with sampling kit:

1. Clippers - used for cutting the axillary process.
2. Cryovial - 2.0 ml pre-labeled plastic vial or tube.
3. Caps – cap for each vial.
4. Sampling rack- plastic box for holding cryovials during sampling.
5. Ethanol (EtOH) – in Nalgene bottle(s).
6. Squirt bottle – to fill and/or "top off" each cryovial with EtOH
7. Sampling instructions
8. Laminated "return address" labels

IV. Shipping: HAZMAT paperwork is required for return shipment of these samples and is included in the kit.

Return shipping code: _____

Ship samples to:

ADF&G – Genetics
333 Raspberry Road
Anchorage, Alaska 99518

Lab staff: 1-907-267-2247
Judy Berger: 1-907-267-2175